What is claimed is

1. A crossflow membrane device for receiving a feedstock at a feed end face and for separating the feedstock into permeate and retentate, comprising:

a membrane support containing at least one monolith of porous material having a feed end face and a retentate end face and defining a plurality of passageways extending longitudinally from the feed end face of the monolith to a retentate end face of the monolith through which the feedstock flows to pass retentate from the device, said passageways having wall surfaces;

a permselective membrane coating of finer pore size than that of the porous material applied to said passageway wall surfaces of the monolith;

at least one permeate conduit formed within the monolith, the conduit containing a plurality of longitudinal permeate chambers communicating with a means of permeate introduction at or near said feed end face and permeate withdrawal at or near said retentate end face;

a means of separating permeate from feed and retentate; and

a means of circulating a portion of the permeate through the permeate conduit to create a decreasing permeate pressure within the permeate chambers from the feed end of the membrane device to the retentate end of the device.

2. The device of claim **1** in which the membrane support is a single monolith.

3. The device of claim **1** in which the membrane support is a plurality of monolith segments.

4. The device of claim **1** in which the permselective membrane is a membrane with a pore size in the range of 10 nanometers to 1 micron and is suitable for an ultrafiltration or microfiltration process.

5. The device of claim **1** in which the means of permeate introduction and withdrawal are channels which communicate with an annular space between the membrane device and a permeate collection housing.

6. The device of claim **5** in which the annular space is filled with a flow resistance material to reduce permeate flow through the annular space from the feed end of the device to the retentate end of the device.

7. The device of claim **6** in which the flow resistance material is a constrained bed of granular material selected from the group of ceramic, glass, metallic or polymeric granular materials.

8. The device of claim **6** in which the flow resistance material is a metal or plastic mesh.

9. The device of claim **1** in which the means of permeate introduction and withdrawal are ducts at the feed end face and the retentate end face, respectively.

10. The devices of claim 1 in which the cross-sectional area of the permeate chambers is reduced from the cross-sectional area of the chambers that would otherwise exist for a monolith support with a uniform and unmodified passageway structure.

11. The devices of claim **10** in which the chamber cross-sectional area is reduced during the monolith support fabrication process.

12. The devices of claim **10** in which the chamber cross-sectional area is reduced by plugging chambers of the monolith support during the device fabrication process.

13. The devices of claim **10** in which the chamber cross-sectional area is reduced by filling chambers of the monolith support with a constrained bed of granular material during the device fabrication process.

14. A crossflow membrane device for receiving a feedstock at a feed end face and for separating the feedstock into permeate and retentate, comprising:

a membrane support containing a porous ceramic monolith having a feed end face and a retentate end face and defining a plurality of passageways extending longitudinally from said feed end face of the monolith to said retentate end face of the monolith through which the feedstock flows to pass retentate from the device, said passageways having wall surfaces;

a permselective membrane coating with a mean pore size between 10 nanometers and 1 micron applied to said passageway wall surfaces of the monolith;

a permeate collection housing with a means of separating permeate from feed and retentate at the feed end face and retentate end face, respectively;

at least one permeate conduit formed within the monolith, the conduit containing a plurality of longitudinal permeate chambers communicating with at least one transverse channel for permeate introduction near the feed end face and at least one transverse channel for permeate withdrawal near the retentate end face; and

a means of circulating a portion of the permeate through the permeate conduit to create a decreasing permeate pressure within the permeate chambers from the feed end of the membrane device to the retentate end of the device.

15. A method of separating a feedstock in a crossflow membrane device having an internal permeate conduit into a permeate and retentate, which method comprises:

a) providing a crossflow membrane device contained within a permeate collection housing and means for separating feedstock and retentate from permeate;

b) introducing a feedstock into the feed end face of the device and into a plurality of the device passageways for separation into a permeate and retentate;

c) removing the retentate from the retentate end face of the device;

d) collecting the permeate in a permeate collection zone and removing from the device; and

e) circulating a portion of the withdrawn permeate through the internal permeate conduit co-currently with feedstock flow to provide a decreasing permeate pressure within the permeate chambers from the feed end of the membrane device to the retentate end of the device.

16. A crossflow membrane device for receiving a feedstock and for separating the feedstock into permeate and retentate, comprising:

a membrane support containing at least one monolith of porous material having a feed end face and a retentate end face and defining a plurality of passageways extending longitudinally from the feed end face of the monolith to a retentate end face of the monolith through which the feedstock flows to pass retentate from the device, said passageways having wall surfaces;

a permselective membrane coating of finer pore size than that of the porous material applied to said passageway wall surfaces of the monolith;

at least one permeate conduit formed within the monolith, the conduit containing a plurality of longitudinal permeate chambers communicating with at least one channel

for permeate introduction at or near said feed end face and at least one channel for permeate withdrawal at or near said retentate end face; and

a driving force for circulating a portion of the permeate through the permeate conduit to create a decreasing permeate pressure within the permeate chambers from the feed end of the membrane device to the retentate end of the device.